
2012 Sensorimotor Risk Standing Review Panel

Status Review for:

Risk of Impaired Control of Spacecraft, Associated Systems and Immediate Vehicle Egress Due to Vestibular/Sensorimotor Alterations Associated with Space Flight

Comments to the Human Research Program, Chief Scientist

2012 Sensorimotor Risk Standing Review Panel (SRP) Status Review WebEx/teleconference
Participants:

SRP Members:

Malcolm Cohen, Ph.D. (chair) – NASA Ames Consultant (retired)
Susan Herdman, Ph.D. – Emory University
John Krakauer, M.D. – The Johns Hopkins Hospital
James Lackner, Ph.D. – Brandeis University

National Space Biomedical Research Institute (NSBRI):

Charles Oman, Ph.D. (MIT)

NASA Johnson Space Center (JSC):

David Baumann
Jacob Bloomberg, Ph.D.
Ronita Cromwell, Ph.D.
Craig Kundrot, Ph.D.
Linda Loerch, Ph.D.
Sarah Lumpkins
Lisa Milstead, Ph.D.
Ajitkumar Mulavara, Ph.D.
Millard Reschke, Ph.D.
Cedric Senter, M.D.
Susan Steinberg, Ph.D.
Laura Taylor, Ph.D.
Scott Wood, Ph.D.

NASA Headquarters (HQ):

Bruce Hather, Ph.D.

NASA Research and Education Support Services (NRESS):

Tiffin Ross-Shepard

On February 26, 2013, the Sensorimotor Risk SRP, participants from the JSC, HQ, NSBRI, and NRESS participated in a WebEx/teleconference. The purpose of the call (as stated in the Statement of Task) was to allow the SRP members to:

1. Receive an update by the Human Research Program (HRP) Science Management Office (SMO) on the status of NASA's current and future exploration plans and the impact these will have on the HRP.
2. Receive an update on changes within HRP (for example, movement of the Integrated Research Plan (IRP) online, gap rewriting, etc.).
3. Receive an update by the Element or Project Scientist on progress since the 2011 SRP.
4. Participate in a discussion with SMO and the Element regarding possible topics to be addressed at the face-to-face 2013 SRP meeting.

Based on the presentations and the discussion during the WebEx/teleconference, the SRP would like to relay the following information to Dr. Kundrot, the HRP Chief Scientist (Acting).

1. The SRP thinks that Dr. Bloomberg and his team's progress and plans seem to be well aligned with the overall stated program goals, especially given the current uncertainty regarding specific future human space missions.
2. The SRP thinks that the sensorimotor program appears to be both pragmatically oriented and scientifically valid. Also, the SRP considers the interactions of sensorimotor researchers with those from other discipline areas to be a real plus.
3. The SRP thinks that the inclusion of the brain imaging work by Rachael Seidler, Ph.D. (University of Michigan) on astronauts who have been on the International Space Station (ISS) and on participants in the bed rest studies is potentially very important. It will be very interesting to see how these factors affect brain activation in sensorimotor areas.
4. The SRP thinks that automated landing, with several automated backups, may be preferable to the default of manual landing in light of the altered spatial awareness, manual dexterity and visual acuity problems engendered during long periods of low gravity and the transition to a gravity environment.
5. The SRP raised concerns about the Functional Task Test study given the variations in individual performance as to whether or not there will be sufficient data to identify relationships between physiological changes and functional performance. This does not imply that the study should not occur.
6. There seems to be a disconnect between the simplicity of some of the test tasks and the complexity of the functional tasks the astronauts have to perform. Although the simple tasks have a "pedigree", a long history of studies whose results enrich and are enriched by the proposed studies, the SRP thinks that these simple tasks may not adequately represent changes in performance under operational conditions.
7. The SRP thinks that a taxonomy should be developed to express the type of learning (adaptation) that is needed under various specific circumstances; the taxonomy could help to avoid confusion and the possible mis-assignment of tasks as tests of adaptation and adaptive capabilities under these circumstances.

8. During the presentation, it was briefly mentioned that there is a new study that will explore “Remote Rehabilitation”, specifically, to explore how self-administered rehabilitation can be done using the Smart System, which the SRP assumes is the force platform by NeuroCom International. If so, the SRP would suggest that focusing exclusively on the Smart System may be too limiting.

Items the SRP would like discussed during the Fall 2013 SRP meeting:

1. The SRP thinks that the new initiative to test cosmonauts virtually immediately upon return from spaceflight is potentially very important. It will be essential to have a broad range of measures of balance and motor control that can yield quantitative interpretable data. If possible, the SRP recommends tracking at least the initial time course of recovery of function.
2. Is it possible for some of the sample collections to be taken during the transport back to NASA JSC?
3. The SRP recognizes that not all tests can be performed during the first hour following landing, and that there must be some prioritizing regarding which tests are given; the prioritization should be based on the temporal stability of the changes to be measured and the amount of time available in which to measure them. It would be useful to know what guidelines, if any, have been established for determining which tests are given first, etc. If there are no guidelines, perhaps this should be placed on the agenda for discussion during the next SRP meeting.
4. The SRP thinks that the sensorimotor research team already has a substantial amount of data on balance and motor control for astronauts returning from shuttle missions and from the ISS and it would be nice to have at our next meeting an overview of these results, accompanied by some indication of the range of individual differences. Also, it would be useful to have information regarding any factors that may be predictive of individual differences in sensorimotor performance and recovery.
5. A key piece of information presented at the briefing related to the one week of available personnel time for conducting experiments on the ISS. Dr. Bloomberg discussed the time available for all experiments, and the SRP thinks it would be useful to learn how much could be made available for sensorimotor experiments.
6. The SRP thinks it would also be useful to learn about the relative priority of the sensorimotor experiments that are conducted on returning ISS astronauts. How much time is available for testing? What priority is given to the sensorimotor tests? How soon after landing are the astronauts tested? This type of information is critical for planning successful interpretable experiments on sensorimotor control because it delimits the scope of what is possible. Here it would also be useful to know how much control the sensorimotor group has over the scheduling of their experiments versus the scheduling of rehabilitative procedures post flight.

7. A significant effort has been devoted to training astronauts to learn how to learn in new experimental situations. The goal is to determine whether astronauts can be taught general techniques that allow them to enhance their rate of adaptation to new sensorimotor environments. The SRP thinks it would be useful to have a review of this work at the next meeting and a description of plans for future work on this theme.
8. Space motion sickness continues to be an enduring operational problem. It would be useful to have a review of current findings and also a summary of the frequency and severity of motion sickness after return from flight. For the post-flight disturbances, it would be valuable to have a list of predisposing factors and an idea of the time course of recovery.
9. The SRP would like a discussion on the validity of the mouse model for sensorimotor issues, specifically should the mouse model continue to be used? Should centrifugation continue to be used, given the differences in otoconia changes that have been reported under centrifugation and under prolonged exposure to microgravity?